

## Opis zajęć (syllabus)

Nazwa zajęć/Course title:	<b>Immunologia ogólna</b>	<b>ECTS</b>	<b>4</b>
Nazwa zajęć w j. angielskim/ Course title in English:	<b>Immunology</b>		
Zajęcia dla kierunku studiów/ Degree program name:	<b>Biotechnology</b>		

Język kursu/ Course language: English		Poziom studiów/Study level: I	
Typ studiów/ Form of studies	<input checked="" type="checkbox"/> intramural <input type="checkbox"/> extramural	Status zajęć/ Course status	<input type="checkbox"/> podstawowe/ Basic <input checked="" type="checkbox"/> kierunkowe/ major <input checked="" type="checkbox"/> obowiązkowe/ mandatory <input type="checkbox"/> do wyboru/ elective
		Semestr/Semester: 5	<input checked="" type="checkbox"/> semestr zimowy/ winter semester <input type="checkbox"/> semestr letni/ summer semester
Rok akademicki/Academic year		2022/23	Numer katalogowy/ Catalogue number: <b>BBT_BTa-1S-5Z-41</b>

Koordynator zajęć/Course coordinator:	<b>Dr hab. Małgorzata Gieryńska</b>
Prowadzący zajęcia/ Teachers responsible for the course:	Academic teachers of the Department of Preclinical Sciences of the Institute of Veterinary Medicine. PhD students in accordance with the applicable internal legal act. Other specialists depending on the needs and possibilities
Założenia, cele i opis zajęć/ Aims, objectives and description of the course:	<p>Basic (contemporary) immunology has its roots in microbiology, genetics, biochemistry, molecular biology, biotechnology, pathology, and clinical observations. The major goal of this course is to impart understanding of the relations between host defence mechanisms and infectious agents, also the ability of the immune system to recognize the altered self-cells. Effort is focused on understanding mechanisms that enable to design of efficacious vaccines that eventually control animal infectious diseases. The expected learning outcomes of this course is acquisition, by students, the working knowledge of immunological principles as they relate to the cells and molecules of immune system, how they develop and acquire the ability to recognize foreign antigens, and finally how they malfunction in autoimmune diseases and how they become inadequate in immunodeficiencies. Upon completion of this course student should be able to explain innate body defences and the adaptive immune responses and apply this understanding to the pathogenesis of infectious diseases as well as to prophylactic and control measurements. Furthermore, student will be able to discuss the types and explain the basis of hypersensitivity as well as the causes and effects of primary and secondary immunodeficiencies, and autoimmune diseases. Intention of the course is presentation of methods suitable for immunity assessment and the possibility of using these assays in the diagnosis of infectious diseases as well as teaching basic serological techniques and evaluation of serological test results. Additionally, demonstration of the techniques of isolation and culture of the lymphocytes and measurement their activity <i>in vitro</i> will be included. Students should develop the ability to work both independently and within the team in the laboratory, draw appropriate conclusions from experimental results and develop an information base for undertaking appropriate decision in regard to animal diseases</p> <p><b>Lectures content: the following issues will be presented during 30 lecture hours</b></p> <ol style="list-style-type: none"> <li>1. Introduction to the veterinary immunology. Primary and secondary lymphoid organs. Types of immunity. Innate immunity. Pattern recognition receptors (PRR), their distribution and role in the induction of the immune response. (2h)</li> <li>2. Cell signaling: chemokines, cytokines and their receptors; their role in coordinating the functions of immune cells. Cells of the innate immunity (mast cells, phagocytes [monocytes, macrophages, granulocytes], natural killer cells, dendritic cells) and their role in immune response development; humoral and cellular mechanisms of innate immunity – inflammation (2h)</li> <li>3. Humoral and cellular mechanisms of innate immunity: inflammation, phagocytosis and its relevance, complement system and other humoral mediators (2h)</li> <li>4. Induction of the adaptive immune response: relevance of antigen presenting cells (dendritic cells, macrophages, B cells); antigen presentation in the context of major histocompatibility complex class I and class II, as well as in the context of CD1 molecule. Definition of the antigen and superantigen; definition and significance of immunological synapse (2h)</li> <li>5. Humoral adaptive immunity. B cell formation and maturation; structure and role of BCR. Structure and classes of immunoglobulins. B cells as effector cells of the humoral immune response (2)</li> <li>6. Adaptive cell-mediated immunity. Formation and maturation of <math>T\gamma\delta</math> cells and <math>T\alpha\beta</math> (<math>CD4^+</math> and <math>CD8^+</math>) cells, as well as NKT cells. Induction and effector mechanisms of adaptive cell-mediated immune response (2h)</li> <li>7. Primary and secondary immune response and their regulation. Immunological memory and its regulation (2h)</li> <li>8. Vaccine – active immunization against infectious diseases, introduction to prophylactic vaccination (2)</li> <li>9. Humoral and cell-mediated mechanisms of local immunity; immunity at body surfaces – mucosal and skin immunity (2h).</li> <li>10. Protective immunity – bacterial, viral, and fungal infectious diseases; immune evasion by bacteria, viruses and fungi (2)</li> <li>11. Regulation of the acquired immunity. T cell and B cell tolerance. Control of the immune response. Regulatory cells. Types of hypersensitivity. Selected topics related to autoimmune diseases (2)</li> <li>12. Immunity of transplantation: types of grafts, mechanisms related to graft rejection/survival, immunosuppression (2h).</li> <li>13. Transfer of the immunity from mother to the young. Maternally derived antibody (MDA) in protection of the offspring; serotherapy (2h).</li> <li>14. Primary and secondary immunodeficiencies (2h)</li> <li>15. Immunity to tumors. Failure of anti-tumor immunity. Immunotherapy in neoplastic diseases (2h).</li> </ol> <p><b>Laboratory practicals content; 5 meetings of 3 hours each, the following topics will be presented within 15 hours</b></p> <ol style="list-style-type: none"> <li>1. The introduction to serology. Definition of the serum. Immunodiagnostic techniques. Reagents used in serological qualitative and quantitative tests. Titration of the antibodies. Secondary binding tests: agglutination.</li> <li>2. Secondary binding tests (cont.). Precipitation. Immunodiffusion and immunoelectrophoresis tests.</li> <li>3. Immunodiagnostic techniques. Assays that use indicator systems. Serum neutralization and complement fixation tests. Application of serological tests in diagnostics.</li> <li>4. Primary binding tests. Application of monoclonal antibodies: immunofluorescence, immunoenzyme (ELISA, Western</li> </ol>

		Blotting, immunohistochemistry) assays and radioimmunoassay. 5. Immunophenotyping qualitative and quantitative evaluation of immune cells. Flow cytometry, magnetic separation. Methods of cell mediated immunity (CMI) evaluation: proliferation test and cytotoxicity test. Assays for cytokine profile assessment.		
Formy dydaktyczne, liczba godzin/ Teaching forms, number of hours:		a) Lectures (15 weeks x 2h); liczba godzin 30h; b) Laboratory classes (5 weeks x 3h); liczba godzin 15;		
Metody dydaktyczne/Teaching methods:		<u>Lectures</u> : multimedia presentations discussing selected topics in immunology (see 'Lecture content'), prepared by employees of Department of Preclinical Sciences, responsible for conducting lectures <u>Laboratory practicals</u> : introduction to the current topic: original multimedia presentations prepared by the academic teachers, focused on the topic of laboratory practicals (see 'Laboratory practicals content'); students individually or in 2 persons team, perform basic serological diagnostics assays (using provided material); interpretation of the assay in the context of the immune response mechanisms responsible for the observed results, discussion with the teacher. Additional meetings with students – consultations: 2h / week.  The detailed organization of the Immunology course will be provided at the beginning of the semester The method of organizing consultations will be determined by the course coordinator at the beginning of the semester.		
Wymagania formalne i założenia wstępne/ Formal requirements and prerequisites		Participation in Immunology course requires knowledge of the following subjects: biochemistry, animal physiology and microbiology (according to the study program) The student must know the metabolism and mechanisms of biochemical reactions in an animal cell / organism, the physiology of organs and organism systems, understand the relationship between the activity of individual systems and organs under physiological conditions, know the concepts of pathogenicity, virulence and invasiveness of infectious agents		
Efekty uczenia się/Learning outcomes:		treść efektu przypisanego do zajęć/the content of the effect assigned to the course:	Odniesienie do efektu kierunkowego /Relation to the course outcomes	Siła dla ef. kier* /Impact on the course outcomes *
Wiedza (absolwent zna i rozumie) /Knowledge: (the graduate knows and understands)	W1	understands the structure and functions of individual parts of the immune system in the context of the physiology of other body systems	K_W02 K_W06	2 2
	W2	knows and describes the mechanisms of innate and adaptive immunity	K_W02 K_W06 K_W08	1 2 2
	W3	knows and describes the mechanisms responsible for general and local immune response induction as well as the methods required for assessment those types of immune responses	K_W06 K_W08	2 2
	W4	understands the mechanisms of regulation of the immune response induced by the infectious agents and cancer	K_W06 K_W08 K_W10	1 2 2
	W5	knows the types of vaccines, understands the mechanisms of their mode of action and the need for immunoprophylaxis of infectious diseases in humans and animals	K_W02 K_W08 K_W10	1 2 2
	W6	knows the mechanisms related to the transfer of passive immunity from the mother and understands the causes of immune disorders related to maternal antibodies	K_W05 K_W06 K_W08 K_W10	1 2 2 2
	W7	knows the mechanisms and describes the development of all types of hypersensitivity reactions and the consequences resulting from these mechanisms	K_W05 K_W06 K_W08 K_W10	1 2 2 2
	W8	knows and describes the causes and effects of the innate and adaptive immunodeficiencies	K_W02 K_W05 K_W06	1 2 2
	W9	knows the basis of autoimmune diseases in humans and animals	K_W05	2
	W10	understands the importance of the use of serological tests (qualitative and quantitative) in the diagnosis of infectious diseases and the relationship between selected disciplines within the areas of natural sciences	K_W04 K_W07 K_W10	2 2 2
Umiejętności (absolwent potrafi) /Skills: (the graduate is able to)	U1	is able to prepare serum for serological assays	K_U01 K_K03	2 3
	U2	is able to perform a simple serological test (quantitative and qualitative serological assays like agglutination test, immunodiffusion assay and neutralization test) and to interpret the results of serological tests in the context of the diagnosis of infectious diseases	K_U01 K_K03	2 3
	U3	is able to use monoclonal antibodies conjugated with the appropriate markers in the context of the diagnosis of infections and the assessment of the patient's health (immunofluorescence, immunoenzyme and radioimmunological assays); detection of antibodies in the patient's serum or identification of an infectious agent	K_U01 K_U03	1 2
	U4	on the basis of the acquired knowledge is capable to isolate specific populations of immunocompetent cells, and to determine their activity using immunoenzyme and immunofluorescence techniques, and molecular biology technique	K_U01	2
Kompetencje (absolwent jest gotów do) /Competences:	K1	formulates opinions in the context of the importance of immunology and serological tests applied in the diagnosis of infectious diseases, autoimmune diseases, and the identification of immunodeficiencies	K_K01	2

(The graduate is ready to	K2	is aware of the necessity to use immunoprophylaxis of infectious diseases in humans and animals	K_K02	2
	K3	is ready to apply the obtained knowledge and skills in further stages of education	K_K02	2
	K4	is aware of obtained knowledge and the benefits of exchanging opinions and is ready to share their competences with colleagues	K_K06	3
	K5	is aware of the need to constantly expand knowledge and improve own skills with the use of scientific sources	K_K02	3

*Treści programowe zapewniające uzyskanie efektów uczenia się:*

*/Program contents ensuring the achievement of the learning outcomes:*

Presentation of the innate and adaptive protective mechanisms and their relationships and dependencies in health and disease. Presentation of the development of immunity in the course of infectious diseases, as well as the evasion of immune mechanisms by infectious agents. Topics: the morphology and phylogenesis of the immune system, types of immunity; innate immunity. Innate immunity characteristics of pattern recognition receptors (PRRs) detecting microbe-associated molecular patterns (MAMPs) and their role in the initiation of the immune response. Cytokines, chemokines and their role in the coordination of the functions of immunocompetent cells. Cells of the innate immunity (mast cells, granulocytes, macrophages, dendritic cells, NK cells) and their role in the development of the immune response. Humoral and cellular mechanisms of the innate immunity: inflammation, phagocytosis and its importance, complement system and other humoral factors. Induction of the adaptive immune response: role of antigen presenting cells (macrophages, dendritic cells, B cells); mechanisms of the antigen presentation in the context of the major histocompatibility complex (MHC) of class I and II, and in the context of CD1 molecule. The concept of antigen and superantigen; definition and the function of the immunological synapses. Humoral adaptive immunity. B cells formation and maturation, structure and role of BCR. Structure and classes of immunoglobulins. B cells as the effector cells of the humoral immune response. Cell-mediated adaptive immunity. Formation and maturation of  $\gamma\delta$ T cells and  $\alpha\beta$ T cells ( $CD4^+$  T cells and  $CD8^+$  T cells), NKT cells. Induction and effector mechanisms of the cell-mediated immunity. Regulation of the immune response. Vaccines - active immunization against infectious diseases, introduction to prophylactic vaccination. Humoral and cell-mediated mechanisms of local immunity; immunity at body surfaces – mucosal and skin immunity. Protective immunity – bacterial, viral, and fungal infectious diseases; immune evasion by bacteria, viruses and fungi. Regulation of the acquired immunity. T cell and B cell tolerance. Control of the immune response. Regulatory cells. Types of hypersensitivity. Selected topics related to autoimmune diseases. Immunity of transplantation: types of grafts, mechanisms related to graft rejection/survival, immunosuppression. Transfer of the immunity from mother to the young. Maternally derived antibody (MDA) in protection of the offspring. Serotherapy. Primary and secondary immunodeficiencies. Immunity to tumors. Failure of anti-tumor immunity. Immunotherapy in neoplastic diseases

Serology – antigen and antibody reaction under *in vitro* conditions. Definition of the serum, obtaining patient's serum. Immunodiagnostic techniques. Reagents used in serological qualitative and quantitative tests. Titration of the antibodies. Serum titre. Secondary binding tests: agglutination, precipitation, immunodiffusion and immunoelectrophoresis tests. Assays that use the indicator systems. Serum neutralization and complement fixation tests. Application of serological tests in diagnostics. Primary binding tests. Application of monoclonal antibodies: immunofluorescence, immunoenzyme (ELISA, Western Blotting, immunohistochemistry), assays and radioimmunoassay. Immunophenotyping: qualitative and quantitative evaluation of immune cells: flow cytometry, magnetic separation. Methods of cell mediated immunity (CMI) evaluation: proliferation test and cytotoxicity test. Assays for cytokine profile assessment.

*Sposób weryfikacji efektów uczenia się/  
Methods of the verification of the learning outcomes:*

- Attendance during laboratory practical classes is verified – the student can be absent in 20% of classes. That means, 1 absence during the semester

- The 3 progressive assessments and the final exam are conducted in the in-contact form. However, in cases depending on the current external conditions determined by the published legal acts, the form of evaluation tests as well as the exam will be modified from the in-contact form to the remote form, applying either Moodle platform or MS Teams platform. In such a case, the evaluation tests and the exam will be conducted in the form of a **multiple-choice test**. The students will be informed in advance about the changes regarding the evaluation tests and the exam. Otherwise, the tests will be carried out in the in-contact form with open-ended questions.

- 3 progressive assessments per semester are scheduled at the beginning of the course and are carried out in the in-contact form. Each written progressive assessment consists of 6 open questions (2 points per question), maximum grade 12 points. The knowledge that student acquired by participating lectures and practical classes will be evaluated. The scope of the material for the partial written assessments will be given at the beginning of the semester. There is 1 retake for each assessment. The same criteria apply to both terms (1 and 2).

Possible grades to obtain from one assessment	
Grade	Number of points
5	12
4.5	11
4.0	10
3.5	8-9
3.0	7
2	6,5 or less

Only those students, who participated in the practical classes and obtained a positive grade (grade at least 3.0 and higher), from the three consecutive partial written assessments, will be allowed to the final exam. The final grade, allowing to the final Immunology exam admittance, consists of grades obtained from 3 progressive written assessments during semester. The final exam consists of 8 open questions (maximum 2 points per question), and includes the knowledge student acquired during lectures and practical classes during the semester. It is possible to obtain 16 points from the exam. There is foreseen only one retake with the same criteria applied for both deadlines.

In case of excused absence at the final exam, the student does not lose the deadline. No extra assessment methods are anticipated.

Grades from the final exam	
Grade	Number of points
5	15-16
4.5	13-14

		<table border="1"> <tr><td>4.0</td><td>11-12</td></tr> <tr><td>3.5</td><td>9-10</td></tr> <tr><td>3.0</td><td>8.5</td></tr> <tr><td>2</td><td>8 or less</td></tr> </table>	4.0	11-12	3.5	9-10	3.0	8.5	2	8 or less						
4.0	11-12															
3.5	9-10															
3.0	8.5															
2	8 or less															
Szczegóły dotyczące sposobów weryfikacji i form dokumentacji osiągniętych efektów uczenia się /Details on the verification methods and of the ways of documenting the learning outcomes:	Entry in the EHMS and Immunology course documentation: individual student evaluation cards, attendance lists, sets of questions for written partial assessments and the final exam, signed students written test, and signed students written final exam, Immunology course regulations)															
Elementy i wagi mające wpływ na ocenę końcową/ <i>Elements and weights influencing the final grade:</i>	<p>The final grade of the Immunology course consists of the grade allowing for the admittance to the exam (50%), and the grade of the exam (50%). There is foreseen one retake with the same criteria applied for both deadlines. In case of excused absence at the final exam, the student does not lose the deadline</p> <table border="1"> <thead> <tr><th colspan="2">Grades to complete the Immunology course</th></tr> </thead> <tbody> <tr><td>5</td><td>4,75-5</td></tr> <tr><td>4.5</td><td>4,25-4,5</td></tr> <tr><td>4.0</td><td>3,75-4,0</td></tr> <tr><td>3.5</td><td>3,25-3,5</td></tr> <tr><td>3.0</td><td>3,0</td></tr> <tr><td>2</td><td>2</td></tr> </tbody> </table>		Grades to complete the Immunology course		5	4,75-5	4.5	4,25-4,5	4.0	3,75-4,0	3.5	3,25-3,5	3.0	3,0	2	2
Grades to complete the Immunology course																
5	4,75-5															
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3.5	3,25-3,5															
3.0	3,0															
2	2															
Miejsce realizacji zajęć/ <i>Teaching place:</i>	Lecture hall at the Faculty of Veterinary Medicine, laboratories in the Department of Preclinical Sciences.															
Literatura/ <i>Literature:</i>	<p>There are many reference books that should be used to supplement lectures and laboratory practicals. A wide variety of general, applied health and health profession immunology textbooks are available in the Faculty and University libraries. Various veterinary medical textbooks have large sections devoted to infectious diseases and immune response.</p> <p>The following immunology textbooks are suggested for further reading:</p> <ul style="list-style-type: none"> <li>- Veterinary immunology. An introduction – Ian Tizard; 8<sup>th</sup>, 9<sup>th</sup>, 10<sup>th</sup> Editions (2009, 2013, 2017)</li> <li>- The Immune Response. Basic and Clinical Principles - Tak W. Mak and Mary E. Saunders, 2005</li> <li>- Basic Immunology. Functions and Disorders of the Immune System - Abul K. Abbas and Andrew H. Lichtman, 6<sup>th</sup> Edition, 2019</li> <li>- Janeway's immunobiology - Kenneth P. Murphy, Paul Travers, Charles Janeway, Mark Walport; 8<sup>th</sup>, 9<sup>th</sup>, 10<sup>th</sup> editions (2011, 2016, 2017)</li> <li>- Roitt's Essential Immunology - Delves P.J., Martin S.J., Burton D.R., Roitt I.M, 12<sup>th</sup>, 13<sup>th</sup> editions</li> <li>- Kuby Immunology, J. Punt, S. Stranford, P. Jones, J. Owen, 9<sup>th</sup> Ed, publisher by W. H. Freeman, 2018</li> </ul>															
UWAGI/ANNOTATIONS	<p>The following scale is used to calculate the final grade:</p> <p>100-93,75% pkt - 5,0  87,5-81,25% pkt - 4,5  75-68,75% pkt - 4,0  62,5-56,25% pkt - 3,5  53,12% pkt - 3,0</p>															

\*) 3 – zaawansowany i szczegółowy, 2 – znaczący, 1 – podstawowy/ 3 – significant and detailed, 2 – considerable, 1 – basic,

Wskaźniki ilościowe charakteryzujące moduł/przedmiot/*Quantitative summary of the course:*

Szacunkowa sumaryczna liczba godzin pracy studenta (kontaktowych i pracy własnej) niezbędna dla osiągnięcia zakładanych dla zajęć efektów uczenia się - na tej podstawie należy wypełnić pole ECTS / <i>Estimated number of work hours per student (contact and self-study) essential to achieve the presumed learning outcomes - basis for the calculation of ECTS credits:</i>	<b>60 h</b>
Łączna liczba punktów ECTS, którą student uzyskuje na zajęciach wymagających bezpośredniego udziału nauczycieli akademickich lub innych osób prowadzących zajęcia/ <i>Total number of ECTS credits accumulated by the student during contact learning:</i>	<b>1.8 ECTS</b>